CLAIMS

1. A defect characterization system that provides rapid feedback for troubleshooting or improving a micro-fabrication process, the system comprising:

components for locating defects in a semiconductor wafer, characterizing the defects to determine an appropriate analysis process, and automatically performing the determined analysis process.

2. The system of claim 1, wherein said analysis includes exposing one or more buried surfaces in the wafer and taking an image at the exposed surface.

3. The system of claim 1, wherein the analysis includes performing a chemical analysis at the exposed surface.

4. The system of claim 1, in which the defects are initially found by an inspection system that creates a defect file, the defect file being used to locate the defects using a high resolution imaging system also used to characterize the located defect to determine the analysis process, the analysis process being automatically carried out by the system.

5. The system of claim 4, in which the high resolution imaging system includes at least one of an ion beam imaging system, scanning electron microscope, and an optical microscope.

6. The system of claim 1, in which the analysis process includes cutting multiple cross sectional portions of the wafer and examining said portions with an EDS analysis to provide three-dimension elemental information.

7. A method of characterizing defects in wafers during fabrication in a semiconductor fabrication facility, comprising:

(a) inspecting semiconductor wafers to locate defects;

(b) storing locations corresponding to the located defects in a defect file;

(c) automatically navigating a dual charged-particle beam system to the vicinity defect location using information from the defect file;

(d) automatically identifying the defect and obtaining a charged particle beam image of the defect;

(e) analyzing the charged particle beam image to characterize the defect;

(f) determining a recipe for further analysis of the defect;

(g) automatically executing the recipe to cut a portion of the defect using a charged particle beam, the position of the cut being based upon the analysis of the charged particle beam image; and

(h) imaging a surface exposed by the charged particle beam cut to obtain additional information about the defect.

8. The method of claim 7, further comprising automatically adjusting charged particle beam parameters in accordance with the results of the analysis of the charged particle beam image before automatically executing the recipe.

9. The method of claim 7, in which analyzing the charged particle beam image to characterize the defect includes automatically determining an outline of the defect, a center of the defect, or both an outline and a center of the defect.

10. The method of claim 7, in which automatically identifying the defect and obtaining a charged particle beam image of the defect includes cutting a fiducial in the work piece near the defect.

11. The method of claim 10, in which executing a recipe includes locating the fiducial, aligning an electron beam and ion beam by superimposing the ion beam and electron beam images of the fiducials, and locating the defect by its known displacement from the fiducial.

12. The method of claim 7, in which multiple wafers are inspected and multiple defects are stored in the defect file, multiple defects are identified and imaged using the charged particle beam system, recipes are determined for analyzing the defects, and then the defects are re-located on the wafers and the recipes are executed on the multiple wafers.

13. The method of claim 7, in which analyzing the feature of interest includes automatically adjusting the charged particle beam parameters based upon the size and shape of the defect for optimal elemental analysis using EDS or a similar analytic technique.

14. The method of claim 7, in which automatically identifying the defect includes obtaining a charged particle beam image of an area thought to include the defect and obtaining a

charged particle beam image of a corresponding area without a defect on a reference die and comparing the images to identify the defect.

15. A system for analyzing a defect in an object, comprising:

(a) an electron beam for imaging the object;

(b) an ion beam for milling the object, wherein the electron and ion beams are capable of impacting at a desired location of the object; and

(c) a processing device adapted to be communicatively connected to (i) the electron beam for controlling it to image a desired image portion, and (ii) the ion beam for controlling it to mill a desired milling portion, and

(d) a computer readable media including instructions that when executed by the processing device cause it to control the system for imaging and milling, identifying a defect using information from a defect file, characterizing the defect based upon an image of the defect formed by the electron or ion beam, removing material based upon the defect characterization to expose a covered portion of the defect, and analyzing the exposed portion of the defect.

16. The system of claim 15 in which the instructions further include instructions to cause the ion beam to mill a fiducial in the object near the defect, the fiducial being of a physical nature to convey to the system physical information about the defect.

17. The system of claim 15, wherein the ion beam and the electron beam are aligned to impact the object at overlapping locations.

18. The system of claim 15, wherein the ion beam and the electron beam are aligned to impact the object at different locations, the instructions including instructions to relocate a point on the work piece surface so that it is under the ion beam or under the electron beam allowing either beam to be used to image or mill the same point on the work piece.

19. A system for analyzing a defect in an object, comprising:

(a) an electron beam for imaging the object;

(b) an ion beam for milling the object, wherein the electron and ion beams are capable of impacting at a desired location of the object; and

(c) a processing device adapted to be communicatively connected to: (i) the electron beam for controlling it to image a desired image portion, and (ii) the ion beam for

controlling it to mill a desired milling portion, said imaging and milling being based on instructions executed by said processor device, wherein the instructions include instructions for controlling the ion beam to mill a fiducial mark in the object proximal to the reported defect, the fiducial being of a physical nature to convey to the system physical information about the defect.

20. The system of claim 19, wherein the size of the fiducial mark is proportional to that of the defect thereby allowing the system to determine the relative size of the defect by determining the size of the fiducial mark.

21. The system of claim 19, wherein the instructions include a defect analyzer application and tool components for providing to a user defect analysis tools including a fiducial tool that allows a user to controllably mill the fiducial.

22. The system of claim 19, wherein the tool components include an auto-coincidence tool for achieving beam coincidence by automatically focusing the electron and ion beams using the fiducial mark.

23. A defect analysis system for analyzing defects in a semi-conductor wafer, the system comprising:

at least two charged particle beams for analyzing defects in a wafer; and

at least one processing device with software components to perform analysis on the defect using the at least two charged particle devices; said software components when executed providing a job builder, a sequencer, and a defect explorer.

24. The system of claim 23, wherein the job builder provides an interface that allows a user to construct a defect analysis process to be executed by the sequencer.

25. The system of claim 24, wherein the job builder interface can access tool components including slice and view tool components.

26. The system of claim 24, wherein the job builder interface can access tool components including a pause tool component that allows the user to define conditions for the analysis process to be halted when executed by the sequencer.

27. The system of claim 23, further comprising a database for storing data obtained from analyzing the wafer, the database being connected to both local and remote computers having access to said data through the defect explorer.

28. A defect analysis system for analyzing defects in a semi-conductor wafer, the system comprising:

at least two charged particle beams for analyzing defects in a wafer; and

at least one processing device with software components for performing analysis on defects in the wafer using the at least two charged particle beams, the software components causing the system to (1) automatically relocate a previously identified defect, (2) determine the size and shape of the defect, (3) adjust image magnification of the defect to an appropriate value, (4) adjust charged particle beam parameters, and (5) maintain alignment of the at least two beams as necessitated by changes in beam parameters.

29. The system of claim 28, wherein the software components further cause the system to automatically select an appropriate beam aperture depending on the size and shape of the defect to control the beam size and current.

30. A defect analysis system for analyzing defects in a semi-conductor wafer, the system comprising:

at least two charged particle beams for analyzing defects in a wafer having a plurality of dies;

a controllable stage for receiving and positioning said wafer relative to the at least two beams; and

at least one processing device with software components to perform analysis on the wafer using the at least two charged particle devices; said software components providing a job builder to allow a user to define analysis jobs to automatically be performed on the plurality of dies and a sequencer to execute the defined job and cause the system to analyze the dies according to the defined job, said job builder allowing the user to specify a path traveled by the stage for analyzing the separate dies.

31. The system of claim 30, wherein a serpentine path of stage travel for analyzing the separate dies can be specified.